CLAIMS

What is claimed is:

1. A method for determining a defect characteristic of a composite structure, the method comprising:

determining a first distance from a first reference point of the composite structure to a defect;

determining a second distance from a second reference point of the composite structure to the defect;

using the first and second distances to establish a reference area of the composite structure; and

considering each defect detected within the reference area and producing therefrom a defect characteristic representative of the composite structure.

2. The method of claim 1, wherein considering each defect comprises summing all of the defects detected within the reference area to produce a total defect count for the reference area.

3. The method of claim 2, further comprising dividing the total defect count by the reference area to produce a defect-per-unit area of the reference area.

4. The method of claim 3, further comprising comparing the defect density-per-unit area to a maximum allowable defect density-per-unit area.

5. The method of claim 1, wherein considering each defect comprises:

determining a width for each defect detected within the reference area; and

summing the widths of the defects within the reference area to produce a width total for the reference area.

6. The method of claim 5, further comprising dividing the width total by the reference area to determine a cumulative defect width-per-unit area of the reference area.

7. The method of claim 6, further comprising comparing the cumulative defect width-per-unit area to a maximum allowable cumulative defect width-per-unit area.

8. The method of claim 5, wherein determining a width for each defect within the reference area comprises:

selecting, from a digital image of at least a portion of the composite structure including the reference area, a pixel set for each defect within the reference area representing the width of the corresponding defect;

determining a pixel count for each selected pixel set; and

correlating each of the pixel counts with correlation data to determine the corresponding widths of the defects within the reference area.

9. The method of claim 1, wherein determining a first distance comprises:

determining a linear velocity of a material placement head unit; and

using the linear velocity to determine the first distance.

10. The method of claim 9, wherein using the linear velocity comprises:

determining elapsed time between when a course started and when the detect is detected along the course; and

multiplying the linear velocity by the elapsed time.

11. The method of claim 9, wherein using the linear velocity comprises:

determining elapsed time between when a first defect is detected along a course and when a second defect is detected along the course; and

multiplying the linear velocity by the elapsed time.

12. The method of claim 9, wherein determining a linear velocity comprises:

determining an angular velocity of a compaction roller of the material placement head unit; and

multiplying the angular velocity by a circumference of the compaction roller.

13. The method of claim 12, wherein determining an angular velocity comprises detecting, counting, and establishing frequency of transitions between contrasting portions of a code ring coupled for common rotation with the compaction roller.

14. The method of claim 1, wherein determining a first distance comprises:

counting revolutions of a compaction roller from course start to detection of the defect; and

multiplying the counted revolutions by a circumference of the compaction roller.

15. The method of claim 14, wherein counting revolutions comprises detecting and counting transitions between contrasting portions of a code ring coupled for common rotation with the compaction roller.

16. The method of claim 1, wherein determining a second distance comprises:

summing courses completed to produce a total completed course count; and

multiplying a predetermined course width by the total completed course count.

17. The method of claim 16, wherein summing completed courses comprises tracking receipt of signals from a machine load cell indicating whether pressure is being applied to a compaction roller.

18. The method of claim 1, wherein determining the second distance comprises:

selecting, from a digital image of at least a portion of the composite structure including the second distance, a pixel set representing the second distance;

determining a pixel count for the pixel set; and

correlating the pixel count with correlation data to determine the second distance.

19. The method of claim 1, wherein the reference area comprises a region of the composite structure bounded by the first and second distances.

20. The method of claim 1, wherein the reference area comprises a region of the composite structure bounded by predetermined linear and lateral distances.

21. The method of claim 1, further comprising implementing a user interface for displaying defect data and for allowing at least one user input.

22. The method of claim 1, further comprising:

importing a part model of a composite structure;

overlaying a course grid on the part model; and

displaying to a user the part model and course grid.

23. The method of claim 22, further comprising:

repositioning the course grid overlay when a new ply is started; and

displaying to a user the part model and the repositioned course grid overlay.

24. The method of claim 1, further comprising:

illuminating at least a portion of the composite structure

acquiring an image of the illuminated portion of the composite structure; and

analyzing the image to identify defects in the illuminated portion of the composite structure.

25. A method for determining a defect characteristic of a composite structure, the method comprising:

determining a linear velocity of a material placement head unit along a course being laid;

using the linear velocity to determine a linear distance from a first reference point along the course to a defect of the composite structure; and

determining a lateral distance from a second reference point of the composite structure to the defect.

26. The method of claim 25, wherein determining a linear velocity comprises monitoring revolutions of a compaction roller of the material placement head unit.

27. The method of claim 25, wherein determining a linear velocity comprises:

determining an angular velocity of a compaction roller of the material placement head unit; and

multiplying the angular velocity by a circumference of the compaction roller.

28. The method of claim 27, wherein determining an angular velocity comprises detecting, counting, and establishing frequency of transitions between contrasting portions of a code ring coupled for common rotation with the compaction roller.

29. The method of claim 25, wherein determining a lateral distance comprises:

summing courses completed to produce a total completed course count; and

multiplying a predetermined course width by the total completed course count.

30. The method of claim 29, wherein summing completed courses comprises tracking receipt of signals from a machine load cell indicating whether pressure is being applied to a compaction roller of the material placement head unit.

31. The method of claim 25, wherein determining a lateral distance comprises:

selecting, from a digital image of at least a portion of the composite structure including the lateral distance, a pixel set representing the lateral distance;

determining a pixel count for the pixel set; and

correlating the pixel count with correlation data to determine the lateral distance.

32. A method for determining a defect characteristic of a composite structure, the method comprising:

determining a linear velocity of a material placement head unit along a course being laid by monitoring revolutions of a compaction roller of the material placement head unit;

using the linear velocity to determine a linear distance from a first reference point along the course to a defect of the composite structure;

determining a lateral distance from a second reference point of the composite structure to the defect;

using the linear and lateral distances to establish a reference area; and

summing defects within the reference area to produce a total defect count for the reference area.

33. The method of claim 32, further comprising dividing the total defect count by the reference area to determine a defect density-per-unit area of the reference area.

34. The method of claim 32, wherein monitoring revolutions of a compaction roller comprises detecting, counting, and establishing frequency of transitions between contrasting portions of a code ring coupled for common rotation with the compaction roller.

35. A method for determining a defect characteristic of a composite structure, the method comprising:

determining a linear velocity of a material placement head unit along a course being laid by monitoring revolutions of a compaction roller of the material placement head unit;

using the linear velocity to determine a linear distance from a first reference point along the course to a defect of the composite structure;

determining a lateral distance from a second reference point of the composite structure to the defect;

using the linear and lateral distances to establish a reference area;

determining a width for each defect within the reference area; and

summing the widths of the defects within the reference area to produce a width total.

36. The method of claim 35, further comprising dividing the width total by the reference area to determine a cumulative defect width-per-unit area of the reference area.

37. The method of claim 35, wherein monitoring revolutions of a compaction roller comprises detecting, counting, and establishing frequency of transitions between contrasting portions of a code ring coupled for common rotation with the compaction roller.